

What is claimed is:

1. A light-receiving device comprising:
a substrate;
an intrinsic region formed on the substrate;
5 a first region formed to a relatively shallow depth in the intrinsic region; and
a second region formed to a relatively deep depth in the intrinsic region and
distanced from the first region, wherein the first and second regions are doped with
different conductivity types.

10 2. The light-receiving device according to claim 1, wherein the first region
is doped with p+ type and comprise thereon an electrode patterned in such a way as
to be in discontinuous contact with the first region.

15 3. The light-receiving device according to claim 2, wherein the electrode
is a light-transmittable dielectric electrode.

20 4. The light-receiving device according to claim 3, wherein a
discontinuous control film pattern with a plurality of openings is formed on a part of
the surface of the intrinsic region intended for the formation of the first region, the
first region is formed to a relatively shallow depth using the openings of the control
film pattern, and the dielectric electrode is in contact with the first region at the
openings of the control film pattern.

25 5. The light-receiving device according to claim 4, wherein the control film
is a silicon oxide film.

30 6. The light-receiving device according to claim 1, wherein a
discontinuous control film pattern with a plurality of openings is formed on a part of
the surface of the intrinsic region intended for the formation of the first region and the
first region is formed to a relatively shallow depth using the openings of the control
film pattern.

7. The light-receiving device according to claim 6, wherein the control film
is a silicon oxide film.

8. The light-receiving device according to claim 6, wherein the first region is formed by a shallow diffusion or implantation process and/or the second region is formed by a deep diffusion process.

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9. The light-receiving device according to claim 1, further comprising a silicon oxide film for preventing the exposure of the intrinsic region.

10. The light-receiving device according to claim 1, wherein the first region is formed by a shallow diffusion or implantation process and/or the second region is formed by a deep diffusion process.

11. The light-receiving device according to claim 1, further comprising a separation layer, which is formed on the substrate to provide electrical insulation between the substrate and the intrinsic region.

12. The light-receiving device according to claim 11, wherein the separation layer is formed on the substrate by O₂ implantation.

13. The light-receiving device according to claim 12, wherein the substrate is a silicon-based substrate and the intrinsic region is formed by regrowth of a silicon-based material.

14. The light-receiving device according to claim 11, wherein the substrate is a silicon-based substrate and the intrinsic region is formed by regrowth of a silicon-based material.

15. The light-receiving device according to claim 11, wherein the light-receiving device has a structure with a plurality of light-receiving regions, each of which comprises the intrinsic region, the first region, and the second region, and an isolation region is formed between the light-receiving regions for electrical insulation therebetween.

16. The light-receiving device according to claim 15, wherein the isolation region is formed of an insulation film and poly-silicon (poly-Si).

17. The light-receiving device according to claim 1, wherein the substrate is a silicon-based substrate and the intrinsic region is formed by regrowth of a silicon-based material.

18. The light-receiving device according to claim 1, which is used in a light-receiving device for optical communication, a light-receiving device for optical pick-up, an optical module for optical communication with an integral structure of a semiconductor laser and a light-receiving device, an optical module for optical pick-up, various optical benches with light-receiving devices, and various optoelectronic integrated circuit with a single light-receiving device or a one- or two-dimensional array of a plurality of light-receiving devices.

19. An optoelectronic integrated circuit comprising at least one light-receiving device for receiving light formed on a substrate, wherein the light-receiving device comprises:

an intrinsic region formed on the substrate;

a first region formed to a relatively shallow depth in the intrinsic region; and

a second region formed to a relatively deep depth in the intrinsic region and distanced from the first region, the first and second regions being doped with different conductivity types.

20. The optoelectronic integrated circuit according to claim 19, wherein the first region is doped with p+ type and comprise thereon an electrode patterned in such a way as to be in discontinuous contact with the first region.

21. The optoelectronic integrated circuit according to claim 20, wherein the electrode is a light-transmittable dielectric electrode.

22. The optoelectronic integrated circuit according to claim 21, wherein a discontinuous control film pattern with a plurality of openings is formed on a part of the surface of the intrinsic region intended for the formation of the first region, the

first region is formed to a relatively shallow depth using the openings of the control film pattern, and the dielectric electrode is in contact with the first region at the openings of the control film pattern.

5 23. The optoelectronic integrated circuit according to claim 22, wherein the control film is a silicon oxide film.

10 24. The optoelectronic integrated circuit according to claim 22, wherein the first region is formed by a shallow diffusion or implantation process and/or the second region is formed by a deep diffusion process.

15 25. The optoelectronic integrated circuit according to claim 19, wherein a discontinuous control film pattern with a plurality of openings is formed on a part of the surface of the intrinsic region intended for the formation of the first region and the first region is formed to a relatively shallow depth using the openings of the control film pattern.

20 26. The optoelectronic integrated circuit according to claim 25, wherein the control film is a silicon oxide film.

 27. The optoelectronic integrated circuit according to claim 25, wherein the first region is formed by a shallow diffusion or implantation process and/or the second region is formed by a deep diffusion process.

25 28. The optoelectronic integrated circuit according to claim 19, wherein the light-receiving device further comprises a silicon oxide film for preventing the exposure of the intrinsic region.

30 29. The optoelectronic integrated circuit according to claim 19, wherein the first region is formed by a shallow diffusion or implantation process and/or the second region is formed by a deep diffusion process.

 30. The optoelectronic integrated circuit according to claim 19, wherein the light-receiving device further comprises a separation layer, which is formed on the

substrate to provide electrical insulation between the substrate and the intrinsic region.

31. The optoelectronic integrated circuit according to claim 30, wherein the separation layer is formed on the substrate by O₂ implantation.

32. The optoelectronic integrated circuit according to claim 31, wherein the substrate is a silicon-based substrate and the intrinsic region is formed by regrowth of a silicon-based material.

33. The optoelectronic integrated circuit according to claim 30, wherein the substrate is a silicon-based substrate and the intrinsic region is formed by regrowth of a silicon-based material.

34. The optoelectronic integrated circuit according to claim 30, wherein the light-receiving device has a structure with a plurality of light-receiving regions, each of which comprises the intrinsic region, the first region, and the second region, and an isolation region is formed between the light-receiving regions for electrical insulation therebetween.

35. The optoelectronic integrated circuit according to claim 34, which is used as at least one selected from a light-receiving device for optical communication, a light-receiving device for optical pick-up, an optical module for optical communication with an integral structure of a semiconductor laser and a light-receiving device, an optical module for optical pick-up, various optical benches with light-receiving devices, and various optoelectronic integrated circuits with a single light-receiving device or a one- or two-dimensional array of a plurality of light-receiving devices.

36. The optoelectronic integrated circuit according to claim 30, which is used as at least one selected from a light-receiving device for optical communication, a light-receiving device for optical pick-up, an optical module for optical communication with an integral structure of a semiconductor laser and a light-receiving device, an optical module for optical pick-up, various optical benches

with light-receiving devices, and various optoelectronic integrated circuits with a single light-receiving device or a one- or two-dimensional array of a plurality of light-receiving devices.

5 37. The optoelectronic integrated circuit according to claim 19, wherein the substrate is a silicon-based substrate and the intrinsic region is formed by regrowth of a silicon-based material.

10 38. The optoelectronic integrated circuit according to claim 19, which is used as at least one selected from a light-receiving device for optical communication, a light-receiving device for optical pick-up, an optical module for optical communication with an integral structure of a semiconductor laser and a light-receiving device, an optical module for optical pick-up, various optical benches with light-receiving devices, and various optoelectronic integrated circuits with a
15 single light-receiving device or a one- or two-dimensional array of a plurality of light-receiving devices.

20 39. The optoelectronic integrated circuit according to claim 38, wherein when the light-receiving device is positioned in a two-dimensional array, the optoelectronic integrated circuit is used as a monochromatic or color imaging device.

 40. A method for manufacturing a light-receiving device, the method comprising:

 preparing a substrate;

25 forming an intrinsic region on the substrate; and

 forming first and second regions in the intrinsic region to relatively shallow and deep depths, respectively, wherein the first and second regions are distanced from each other and doped with different conductivity types.

30 41. The method according to claim 40, further comprising forming on the first region an electrode patterned in such a way as to be in discontinuous contact with the first region and wherein the first region is doped with p+ type.

 42. The method according to claim 41, wherein the electrode is a

light-transmittable dielectric electrode.

43. The method according to claim 40, further comprising forming a discontinuous silicon control film pattern with a plurality of openings on a part of the surface of the intrinsic region intended for the formation of the first region and wherein the first region is formed to a relatively shallow depth using the openings of the control film pattern.

44. The method according to claim 43, further comprising forming a dielectric electrode in such a way as to be in contact with the first region at the openings of the control film pattern.

45. The method according to claim 43, wherein the control film is a silicon oxide film.

46. The method according to claim 43, wherein the first region is formed by a shallow diffusion or implantation process and/or the second region is formed by a deep diffusion process.

47. The method according to claim 40, further comprises forming a silicon oxide film for preventing the exposure of the intrinsic region.

48. The method according to claim 40, wherein the first region is formed by a shallow diffusion or implantation process and/or the second region is formed by a deep diffusion process.

49. The method according to claim 40, further comprising forming a separation layer on the substrate to provide electrical insulation between the substrate and the intrinsic region before the formation of the intrinsic region.

50. The method according to claim 49, wherein the separation layer is formed on the substrate by O₂ implantation.

51. The method according to claim 50, wherein the substrate is a silicon-based substrate and the intrinsic region is formed by regrowth of a silicon-based material.

5 52. The method according to claim 49, wherein the substrate is a silicon-based substrate and the intrinsic region is formed by regrowth of a silicon-based material.

10 53. The method according to claim 40, wherein the substrate is a silicon-based substrate and the intrinsic region is formed by regrowth of a silicon-based material.

15 54. The method according to claim 40, wherein when the light-receiving device comprise a one- or two-dimensional array of a plurality of light-receiving regions, each of which has the intrinsic region and first and second regions, the method further comprises forming an isolation region between the light-receiving regions for electrical insulation therebetween.

20 55. The method according to claim 54, wherein the isolation region is formed of an insulation film and poly-Si.

25 56. The method according to claim 40, wherein the substrate is used as a base for at least one selected from a light-receiving device for optical communication, a light-receiving device for optical pick-up, an optical module for optical communication with an integral structure of a semiconductor laser and a light-receiving device, an optical module for optical pick-up, various optical benches with light-receiving devices, and various optoelectronic integrated circuits with a single light-receiving device or a one- or two-dimensional array of a plurality of light-receiving devices.